Modeling Effort Estimates Financial Uncertainties and Risks of Solar Generation

(2011-03-23) - Contributed by Salvatore Salamone

Argonne and Gartner have developed a cost estimate and financial risk methodology to help utilities and investors make decisions when developing new solar power generation systems.

Argonne
National Laboratory, teaming with analyst firm Gartner and using sophisticated
simulation techniques, has developed a methodology for evaluating the lifetime
cost, cost uncertainties and associated financial risks of building and
operating commercial-scale solar power generation systems.

The
researchers believe their approach will give utilities and investors a better
understanding of a system's total costs and help them identify areas where
financial risks can be minimized.

Argonne and Gartner base their
model on the metric called the levelized cost of energy (LCOE), which is
derived by dividing the lifetime cost of the system by the lifetime energy
produced. In contrast, most solar projects today are evaluated based on a
dollar-per-watt estimate. Argonne solar
researcher Seth Darling, who leads the development of the new approach,
said the LCOE metric provides a better way to determine the financial feasibility
of one system over another.

LCOE can
be thought of as the price at which energy must be sold to break even over the
system's lifetime. It is measured in cents per kilowatt-hour and takes into
account the project costs and operating costs. LCOE calculations also include
other factors such as the amount of sunlight in a given location, conversion
efficiency of the solar technology, solar panel degradation rate over time, and
financial considerations including the discount rate and taxes.

The
48 MW Copper Mountain solar facility uses First Solar thin film modules.
(Source: First Solar)

Darling
noted that there is great uncertainty in many of the parameters used in typical
LCOE estimations, yet the calculated LCOE does not capture or reflect those
uncertainties or the potential financial risks associated with them.

The Argonne and Gartner model tries
to address these variations and uncertainties by factoring in the probability
associated with each parameter value instead of a single value. For example,
the researchers studied the 30-year history of solar insolation for Boston, Chicago and Sacramento and created a probability
distribution for each city.

They also
developed probability distributions for degradation rates, discount rates and
operational costs. Essentially, these distributions specify a range of values
for each parameter and the probability that each value will occur. (Darling
noted that the distributions used may not be the best; people should focus on
the methodology, not the specific values used in their model.)

Employing
a commonly used mathematical technique called Monte Carlo simulation, the LCOE is
calculated by picking values from each distribution randomly based on the
probabilities. This process is repeated more than 1 million times.

This
produces a range of LCOE values and estimates of the likelihood of that LCOE's
occurrence. A simulation might find a particular project has an average LCOE of
$0.15 per kilowatt-hour, with a 90 percent certainty that the rate could be
between $0.10 and $0.18.

An
investor could then look at the factors that produce that price variability and
look for ways to reduce financial risks. For instance, the choice of a lower-cost
panel certainly cuts the initial project cost, but a more expensive product
might offer a better degradation rate. Similarly, going with a vendor that has
much more detailed degradation data could limit the uncertainties and thus
reduce the investment risk. If the discount rate is a source of great
uncertainty, a utility might seek other funding or lock in a slightly higher
fixed rate early on to reduce the chance of greater variation over time. Other
factors, such as the amount of sunlight in a given location, obviously cannot
be controlled. Darling noted that the biggest challenge with
using the methodology is that much of the required data is lacking. In
particular, what's needed is a publicly available real-world database across
the country of solar insolation, degradation of materials in specific
locations, and other information used in LCOE calculations.